3. On the Manifestation of Anger, Fear, and other Passions, in Fishes, and on the Use of their Spines.[1] By the Rev. S. J. Whitmee, C.M.Z.S.

[Received January 2, 1878.]

In his remarks on the erection of the dermal appendages by various animals under the excitement of anger and terror Mr. Darwin ('Expression of the Emotions in Men and Animals') confines himself to "three of the great Vertebrate classes," viz. mammals, birds, and reptiles (p. 95). When I first read the passage referred to, I tried to think of some reference to the manifestation of anger by fishes in books with which I am familiar, but I failed to call any to mind. And as Mr. Darwin has not brought forward any examples as to how fishes manifest their "emotions," I am almost compelled to believe no observations have been recorded. I read, too, in the article 'Ichthyology," in the 'Encyclopædia Britannica' (vol. xii. p. 221, 8th ed.), after a fanciful comparison between birds and fishes, to the great disadvantage of the latter, that "the silent dweller in the deep knows few attachments, expresses no language, cherishes no affections, . . . the cravings of hunger seem alone to exercise a frequent and influential action over his monotonous movements;" and that "by whatever scenes in nature fishes are surrounded, their perceptions are probably indistinct and dull" [2].

Notwithstanding that so little appears to be written on the manifestation of feeling by fishes, it strikes me many persons who have kept an aquarium must have noticed that they show anger quite as plainly as any other animals.

For some time past I have kept a good sized aquarium for the instruction and amusement of myself and my family. My house is situated on the coast, and has a belt of shallow and smooth water before it, formed by the coral-reef which runs along in front of it nearly a mile out at sea. This lagoon is a fine place for fishes; and I encourage the natives to bring me any thing remarkable they obtain when fishing there. I have therefore often had fishes belonging to several genera together in my aquarium. Amongst other things I have had opportunities of watching their quarrels, which are by no means infrequent among the individuals of the same species, and which are of constant occurrence between different species and genera. The signs of anger in most fishes are so obvious that one of my boys, between three and four years old, who is fond of making his own observations in natural history, knows an angry fish as well as most people know an angry bull or an angry boar.

[1] This paper was written in Samoa, in October 1875, and is given in its original form. S. J. W., December 27, 1877.

[2] There are other remarks in the article mentioned which, I presume, will be corrected in the new edition of the 'Encyclopædia'—such, *e. g.*, as the statement that the elegant and diversified colours of fishes are probably for the special gratification of man. Unfortunately these quickly disappear when man gets possession of the fish.

When swimming in a placid condition, the anterior portion of the dorsal fin in fishes is seldom elevated; hence the spines which occupy this position are laid back more or less closely, and are often scarcely visible[1]. The anal fin is also often not fully expanded; but I have not usually seen this so marked as in the dorsal. On the least fright up goes the dorsal, and the spines are at once elevated. As an example of how slight a cause will suffice to produce this change, I may mention that, before writing the last sentence, I rose from my desk and lightly tapped the front of my aquarium. The anterior dorsal fins of its inhabitants (previously laid back) were instantly elevated, and all assumed the attitude of attention. Under the influence of great anger or fear, such as would be caused by the presence of a carnivorous fish in the aquarium, the dorsal fin is raised to its extreme height, and the spines, both of the dorsal and anal fins, are very prominent. The scales all over the body are also more or less raised, and with them, of course, any other dermal appendages the particular fish may possess. This causes it to assume larger proportions than under ordinary circumstances.

I believe the spines are elevated under the influence of fear as well as by anger. I was once trying to catch a *Tetrodon nigropunctatus* which was in my aquarium, when it inflated itself and elevated the fine spines with which its body was covered, and which were previously buried in its loose and flabby skin. This of course was under the influence of fear. And this appears to give a hint as to the purpose for which this fish and those of the genus *Diodon* inflate themselves.

When I have observed fishes chasing each other, apparently in playfulness rather than anger, I have often seen them swim at each other with open mouths as if to bite. But when they have appeared to intend a serious attack they have always turned suddenly round and lashed at one another with the caudal fin. I believe serious fighting is always done with the tail. And from their anatomy one would naturally expect this to be the chief mode of attack in most fishes.

I incidentally mentioned this way of fighting by fishes in a paper recently sent to the Society, in which I described an attack made by some small fishes on an *Antennarius*[2]. These little things were evidently in great dread of their carnivorous neighbour. But, like small birds in presence of a bird of prey, they could not keep at a distance, but continually tried to torment it. In attacking it they always took care to strike at its posterior part, although this was protected by a block of coral. I said, in the paper referred to, that this mode of attack by the tail ought to be very effective in the case of an *Acanthurus*, and that it may account for the armature of the Acronuridæ.

In connexion with this subject I will mention a thought which has often occurred to me as to the chief purpose served by fishes'

[1] Drawings of fishes usually represent them with *all* the fins fully expanded and the spines prominent; but this is not their ordinary condition.

[2] See P. Z. S. 1875, p. 545.

spines, viz. protection against the attacks of those of the class which are carnivorous. I have never seen a fish try to use its dorsal spines actively to strike with. But I have seen a *Balistes* swim rapidly past an antagonist, and graze its side with its file-like lateral spines. I am strongly inclined to believe the dorsal and anal spines are used for defence only.

There is little doubt that most carnivorous fish capture their prey by outswimming them, as most carnivorous quadrupeds capture theirs by outrunning them. In the shallow waters within our reefs it is a very common thing to see shoals of fish leaping out of the water when chased by the larger ones which prey upon them. They pass along with a series of springs at a great rate; and the noise they make is heard at a long distance. Most fishes thus chased would, if captured, be seized from behind. If so, the strong spines on the anal and dorsal fins, inclined as they are backwards, would often be of immense value to their possessors in preventing them from being swallowed. I am inclined to believe this is the chief, if not the sole, use of these spines[1].

If this view be correct, those fish most exposed to the attacks of others which are carnivorous ought (other things being equal) to be best protected. I have not given sufficient attention to the subject to say whether this be so or not. But from a merely superficial examination I fancy further investigation would prove that spiny fishes are more frequently found in confined and shallow waters, where they have little opportunity of escape; and that slow-swimming fishes are most frequently protected with peculiar defensive armature. The *Diodon* and *Tetrodon* may serve as examples of the latter. They swim slowly, and if unprotected would be specially liable to be preyed upon by carnivorous fish. Unless alarmed neither look formidable. In both of them the spines are ordinarily concealed in the soft and loose skin; and then they present a very different appearance from the stuffed specimens or plates by which they are chiefly known. But the individuals of both genera possess the power of very rapidly inflating their loose skins, and thus erecting the spines with which they are more or less completely covered. In the case of the *Diodon* there can be no doubt that its inflated and bristling appearance would serve to protect it from attack; and I imagine the most voracious monster would think twice before attempting to feast on the less-protected *Tetrodon*.

[1] Since the above was written I have seen a proof of the correctness of this view as to the use of spines. I was one day passing along the lagoon on the shores of Upolu, when my boatmen noticed a great splashing in the water at a distance. Knowing the cause, they pulled for the place. There we saw a large fish with a smaller one sticking in its jaws, caught apparently by the erected spines. They got separated just as we approached, and before my crew could secure them; but the natives told me they not unfrequently take fishes in that way. Sometimes they find both dead, one firmly sticking by its spines in the jaws of the other.—December 1877.